

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section.
☐ Standing Work Permit

Requester: Don Lynch	Date: 09/24/2013	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 09/24/2013	Est. End Date: 03/31/2014
Brief Description of Work: Mechanical assembly, optical and electrical assembly and test of sPHENIX prototype EMCal and HCal			
Building: 510	Room: 1-142 (Hi Bay Area)	Equipment: sPHENIX Prototype EM & Hadronic calorimeters	Service Provider: PHENIX technicians and sPHENIX experts

2. WCC, Requester/Designee, Service Provider, and ESS&H (as necessary) fill out this section or attach analysis

ESS&H ANALYSIS			
Radiation Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne
	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM
	<input type="checkbox"/> Other		
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			
<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges
	<input type="checkbox"/> X-ray Equipment		
Safety and Security Concerns	<input type="checkbox"/> None	<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material
	<input type="checkbox"/> Pressurized Systems		
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*
	<input type="checkbox"/> Railroad Work		
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Nanomaterials/particles*
	<input checked="" type="checkbox"/> Rigging		
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*
	<input type="checkbox"/> Silica*		
<input type="checkbox"/> Biohazard*	<input type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*
	<input type="checkbox"/> Security Concerns		
<input type="checkbox"/> Chemicals/Corrosives*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*
	<input type="checkbox"/> Suspect/Counterfeit Items		
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input checked="" type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls
	<input type="checkbox"/> Vacuum		
* Safety Health Rep. Review Required	<input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM	<input type="checkbox"/> Other	
Environmental Concerns			
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
	<input type="checkbox"/> Land Use Institutional Controls		
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed
	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive	
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping
Waste disposition by: <input type="checkbox"/> Other			
Pollution Prevention (P2)/Waste Minimization Opportunity: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
FACILITY CONCERNS			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Intermittent Energy Release		
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations
	<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other
<input type="checkbox"/> Configuration Management	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions	
WORK CONTROLS			
Work Practices			
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment
	<input type="checkbox"/> Security (see Instruction Sheet)		
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation
	<input type="checkbox"/> Other		
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")
	<input type="checkbox"/> Electrical Inspection Required		
Personal Protective Equipment			
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input checked="" type="checkbox"/> Gloves as appropriate	<input type="checkbox"/> Lab Coat
	<input checked="" type="checkbox"/> Safety Glasses as appropriate		
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator*
	<input type="checkbox"/> Safety Harness		
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers
	<input checked="" type="checkbox"/> Safety Shoes	<input type="checkbox"/> High visibility cloths/vest	<input type="checkbox"/> Other
Permits Required (Permits must be valid when job is scheduled.)			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems	
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No	
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other	
Dosimetry/Monitoring			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O ₂ /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump	
Training Requirements (List specific training requirements)			
PHENIX Awareness, CA Access or Equiv.			
Based on analysis above, the Review Team determines the risk, complexity, and coordination ratings below:		If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)	
ESS&H Risk Level:	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	WCC:	Date:
Complexity Level:	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	Service Provider:	Date:
Work Coordination:	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	Authorization to start	Date:
(Department/Division, or their equivalent, Sup/WCC/Designee)			

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): See attached Procedure and ESR # PO-054-2013

Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring)

None

Notifications to operations and Operational Limits Requirements: None

Post Work Testing, Notification or Documentation Required:

Job Safety Analysis Required: ☐ Yes ☒ No

Review Done: ☒ in series ☐ team

Reviewed by: * Primary Reviewer signature means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESS&H have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other (PHENIX Escort)				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESS&H concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:
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6. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)

a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

sPHENIX Prototype Assembly and Functional TestsIntroduction

The PHENIX Collaboration is currently proposing a new detector system upgrade to be installed in the current PHENIX experiment location in the RHIC accelerator at BNL. Details of this detector proposal are available from the PHENIX collaboration upon request. As part of the R&D for this proposal, the PHENIX Collaboration is currently building prototypes of the HCal and EMCal detector subsystems to be assembled and operationally checked in the PHYSICS High-Bay area.

The sPHENIX HCal and EM Cal prototypes are intended to demonstrate the feasibility of the full sPHENIX Calorimetry mechanical design and integration while also providing a testbed for the Calorimeters performance, and finally a simplified model that accurately demonstrates the HCal structural integrity under a representative simulation of expected operating conditions.

This work permit and its comprising documents describe the mechanical assembly, electrical and fiber optic component integration, and benchmark operational testing to be performed in the PHYSICS High-Bay Area. All operations not described in detail herein and in attached documentation are worker-planned work in accordance with the policies of BNL, the PHYSICS department and PHENIX as documented in the PHENIX Awareness training.

Work Plan

The Attached drawing set fully describes the sPHENIX HCalPrototype detail design and assembly. The following drawings are included:

SP00-100-001 rev B	sPHENIX Cradle Tower Weldment
SP00-100-002 rev A	sPHENIX Cradle Weldment
SP00-100-003 rev A	sPHENIX Cradle Support Base
SP00-100-010 (Preliminary)	sPHENIX HCal and EMCal Prototype Test Assembly
SP00-100-011 (Preliminary)	sPHENIX HCal Prototype Assembly
SP00-100-012 rev A	sPHENIX Aluminum Base Plate
SP00-100-013 rev A	sPHENIX Pin Cover
SP00-100-014 rev A	sPHENIX Spacer Plate
SP00-100-015 rev A	sPHENIX Boss
SP00-100-016 rev A	sPHENIX Locating Block
SP02-100-011 rev B	sPHENIX Outside HCal Steel

SP02-100-012 rev B	sPHENIX Inner HCal Steel
SP02-100-013 rev B	sPHENIX Outside HCal Steel Clip
SP02-100-014 rev B	sPHENIX Inside HCal Steel Clip
SP02-100-015 rev B	sPHENIX Outer Support
SP02-100-016 rev B	sPHENIX Inner Support
SP02-200-011rev A	sPHENIX Outer Scintillator 1 U Groove
SP02-200-012rev A	sPHENIX Inner Scintillator 2 U Groove
SP02-200-013rev A	sPHENIX Outer Scintillator 2 U Groove
SP02-200-014rev A	sPHENIX Inner Scintillator 1 U Groove
SP02-200-015rev A	sPHENIX Outside HCal "W" Scintillator Tile

In addition, a set of detail and assembly drawings for the EMCal prototype is currently in design. These drawings will be added to this work permit when they are available.

The assembly and testing of the HCal and EMCal in the High-Bay Area of PHYSICS will be performed as worker planned work in accordance with the above drawings and the attached ESR #PO-054-2013. All work shall be performed by fully trained PHENIX technicians and sPHENIX Calorimeter experts in accordance with all of the requirements of this work permit and the attached ESR.

On completion of the assembly of the Calorimeters, a series of operational (QC) checks (TBD) will be performed to test mechanical and electrical operation of the test setup. These tests will be defined and documented elsewhere as appropriate by PHENIX Calorimeter experts. The entire assembly will then be packaged for shipping to Fermi Lab for performance tests. These tests will be planned and documented elsewhere per requirements of Fermi Lab Work Planning and PHENIX Calorimeter experts.

After completion of the Fermi Lab tests, the entire assembly will be packaged and shipped back to BNL where it will be routed back to the PHYSICS High Bay Area for disassembly and final disposition of components.

When this work permit is closed out any anomalies, lessons learned, or other relevant observations concerning the tasks defined above shall be documented and recorded on the back of this work permit and/or on a separate sheet(s), to be attached to this work permit.

The only official copy of this file is the one online at
<https://fsd84.bis.bnl.gov/ESR/>

**Date Printed: Nov 1,
2013**

Experiment Safety Review Form

Review Number: PO-054-2013

PRINCIPAL INVESTIGATOR: Donald Lynch

GROUP: PHENIX

EXT: 2253

E-MAIL: dlynch@bnl.gov

LIFE NUMBER: 20146

Project Title: sPHENIX prototype Calorimeters Assembly
Location(s): 0510
Area(s): 0510-FIRST-1-142
Proposed Start Date and Duration: 8/28/2013 - 1 years

SIGNATURES:

Principal Investigator: Donald Lynch	Date: 8/28/2013
Experiment Review Coordinator: Ronald Gill	Date: 9/24/2013
Co-PI or Alternate Contact (s): Biggs, John Carter	Date: 9/19/2013
Reviewer: Susan Duffin	Date: 9/17/2013
Reviewer: Joseph Vignola	Date: 9/12/2013
Reviewer: Michael Zarcone	Date: 8/30/2013
Reviewer: Dorothy Davis	Date: 9/19/2013
Reviewer: Frank Craner	Date: 9/23/2013
Approval: Laurence Littenberg	Date: 9/24/2013
Review/Approval (ERC) Comments: 09/24/2013 10:37 AM This ESR was reviewed and approved by the Physics Department ESSH Committee. 09/24/2013 10:36 AM	
Walkthrough Signature:	Date:
Expiration Date (max 1 yr.): 9/24/2014	
FUA Change Required? No	
Fire Rescue Run Card Changes Required? No	
Has a NEPA Review been Performed for this Project? Yes	
Required Approvals (i.e., IACUC, IBC, etc.): None	

Project Termination Acceptance Signature:	Date:
Comments:	

I. Define the Scope of the Work

A. Description

Assembly of sPHENIX prototype calorimeters (HCal and EMCal) and operational checkout prior to shipment of components to Fermi Lab for performance tests. This effort requires use of space in Physics Department Hi-Bay area and use of the Hi Bay crane for assembly. The prototype HCal calorimeter is comprised of steel plates, fiber optic imbedded scintillator plates and associated optic sensors and electronics for signal detection and processing. The EMCal prototype is comprised of tungsten plates, fiber optics, sensors and electronics. Mechanical assembly and electrical component integration will be performed by PHENIX mechanical and electrical technicians. The prototype assemblies will be mounted on steel and aluminum adjustable support structures, which, in turn, will be mounted on an existing lift table (already in place in the Physics Hi-Bay area.)

After assembly of components and integration of control electronics, operational tests will be performed to validate the assembly as ready for performance tests.

The assembled equipmentment will then be crated for shipment to Fermi Lab in Illinois for performance tests in the Fermi Lab test beam. After tests at Fermi Lab are completed the assembly will be returned to the Physics Hi-Bay area at BNL for dissassembly and final disposition of components.

All PHENIX technicians involved are experienced in similar work and will be fully trained for all tasks including specific training to operate the Hi-Bay crane.

The electronics is powered by low voltage supplies, mostly Vicor switching supplies, with voltages considerably under 50V (typical voltages are 3.3VDC and 5VDC). The detectors are silicon photomultipliers which require a bias voltage of about 70V, but with extremely small currents, which will be supplied by current limiting power supplies. The Vicor Megapak supply we are using has 400 W plug-in modules (8V@50A).

Although we don't plan to have photomultiplier tubes, we should have the ability to use Bertan high voltage supplies to supply ~2 mA of current at 2 kV for PMT's in case we need counters for triggers.

Equipment manuals or procedures that are controlled documents:

There are no equipment manuals for ESH critical systems. Prior to commencement of assembly, an enhanced work permit will be generated which will include detail component and assembly drawings for the calorimeters.

B. Human Performance Factors

The only human performance factors involved are associated with material handling of components when moving components and assembling. PHENIX technicians and engineers will carefully plan each days activities and select the safest, most effective and most efficient procedures to accomplish each task. All material handling tasks are worker planned work, and care will be taken to accomplish each and every task safely.

C. Waste Minimization/Pollution Prevention

There should be no waste generated during this project. After completion of the project, the system will be disassembled and components will be returned into PHENIX stock for use on future projects.

D. Materials Used /Waste Generated

Materials Used	Disposal Method	Amount per Use	Amount per Year	Comments
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II. Identify and Analyze Hazards Associated with the Work

The following hazards were identified:

Physical Hazards:

- Material handling equipment (e.g., cranes, hoists, forklifts)
- Powered Hand Tools

Chemical Hazards:

- None

Ionizing and Non-ionizing Radiation Hazards:

- None

Biological Hazards:

- None

Offsite Work:

- Reviewed or controlled by ES&H programs at the offsite location

Other Issues (Security, Notifications, Community, etc.):

- None

Significant Environmental Aspects

- None

III. Develop and Implement Hazard Controls and Assess Risk

A. Physical Hazards, Tasks and Controls

Hazard, Default Controls, Task Specific Info	Risk Level
<p>Hazard: Material handling equipment (e.g., cranes, hoists, forklifts)</p> <hr/> <p>Default Controls: Contact SME Comply with Lifting Safety Subject Area</p> <hr/> <p>Task Specific Info: Only personnel on the Physics Department authorized users list, or BNL riggers, may operate the High Bay crane.</p>	Moderate (41-60)
<p>Hazard: Powered Hand Tools</p> <hr/>	Negligible (0-20)

Default Controls:

Inspected for damage prior to use. Follow manufacturer's instructions.
PPE: Safety glasses

B. Chemical Hazards, Tasks and Controls

None

C. Environmental Hazards, Tasks and Controls (include on/off site transportation and products/services)

None

D. Radiation Hazards, Tasks and Controls

None

E. Biological Hazards, Tasks and Controls

None

F. Offsite Work Hazards, Tasks and Controls

Hazard, Default Controls, Task Specific Info	Risk Level
Hazard: Reviewed or controlled by ES&H programs at the offsite location Default Controls: Provide description of work and name of institution controlling ESH. Task Specific Info: Performance tests will be done at FermiLab. All work there will follow the ESH programs and rules at FermiLab.	Acceptable (21-40)

G. Other Issues (Security, Notifications to Other Organizations, Community Involvement, etc.)

None

H. Recommended Exposure Monitoring

- None

Description or comments:

I. EPHA Determination

Chemical Name	Quantity (lbs, gal)	Location (Bldg/Room#)
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IV. Perform Work Within Controls**A. Recommended Training and Medical Surveillance Summary**

- Hand and Power Tool Safety (TQ-TOOLSAFE)

B. Personnel Training, Qualification, and Authorization List

Employee/Guest Name	Life/Guest#	Dept	Required Training Course(s)	Signed
John Haggerty	18233	PO	Hand and Power Tool Safety (TQ-TOOLSAFE) [EXPIRES: NEVER]	

Donald Lynch	20146	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	8/30/2013 11:01:27 AM
Eric Mannel	24903	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	10/26/2013 6:04:21 PM
John Carter Biggs	15639	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Ken Jones	20135	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Frank Toldo	18297	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Stephen Boose	20461	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Michael Lenz	17937	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	10/25/2013 3:52:33 PM
James La Bounty	18643	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Salvatore Polizzo	22241	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Richard Ruggiero	18090	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Edward Kistenev	20207	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	
Craig Woody	15756	PO		9/26/2013 3:49:14 PM
Edward O'Brien	18368	PO	Hand and Power Tool Safety (TQ-TOOLS SAFE) [EXPIRES: NEVER]	

C. Emergency Procedures

None

D. Transportation

None

E. Logistical Interactions

None

F. Termination/Decommissioning

After tests at Fermi Lab are completed the assembly will be returned to the Physics Hi-Bay area at BNL for disassembly and final disposition of components.

V. Provide Feedback

None

VI. Attachments

Attached Files: